housing 102, and five additional passages 122 (only two passages are illustrated) may extend through the housing 102 for pneumatic control of the carrier head. O-rings 124 may be used to form fluid-tight seals between the passages through the housing and passages through the drive shaft.

A2 concl

Please replace the paragraph beginning at page 5, line 1 with the following rewritten paragraph:

The loading chamber 108 is located between the housing 102 and the base assembly 104 to apply a load, i.e., a downward pressure or weight, to the base assembly 104. The vertical position of the base assembly 104 relative to the polishing pad is also controlled by the loading chamber 108. An inner edge of a generally ring-shaped rolling diaphragm 126 may be clamped to the housing 102 by an inner clamp ring 128. An outer edge of the rolling diaphragm 126 may be clamped to the base assembly 104 by the outer clamp ring 134.

A3

Please replace the paragraph beginning at page 5, line 8 with the following rewritten paragraph:

The retaining ring 110 may be a generally annular ring secured at the outer edge of the base assembly 104. When fluid is pumped into the loading chamber 108 and the base assembly 104 is pushed downwardly, the retaining ring 110 is also pushed downwardly to apply a load to the polishing pad. A bottom surface 116 of the retaining ring 110 may be substantially flat, or it may have a plurality of channels to facilitate transport of slurry from outside the retaining ring to the substrate. An inner surface 118 of the retaining ring 110 engages the substrate to prevent it from escaping from beneath the carrier head.

A4

Please replace the paragraph beginning at page 5, line 24 with the following rewritten paragraph:

The volume between the base assembly 104 and the internal membrane 150 that is sealed by the first flap 150 provides a first circular pressurizable chamber 160. The volume between the base assembly 104 and the internal membrane 150 that is sealed between the first flap 150 and the second flap 152 provides a second pressurizable annular chamber 162

A5

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surrounding the first chamber 160. Similarly, the volume between the second flap 152 and the third flap 154 provides a third pressurizable chamber 164, the volume between the third flap 154 and the fourth flap 156 provides a fourth pressurizable chamber 166, and the volume between the fourth flap 156 and the fifth flap 158 provides a fifth pressurizable chamber 168. As illustrated, the outermost chamber 168 is the narrowest chamber. In fact, the chambers 162, 164, 166 and 168 can be configured to be successively narrower.

A5 cancl

Please replace the paragraph beginning at page 8, line 24 and continuing to page 9, line 5 with the following rewritten paragraph:

The two outer chambers 166c and 168c can be used to control the pressure distribution on the outer perimeter of the substrate. If the pressure P_1 in the outermost chamber 168c is greater than the pressure P_2 in the second chamber 166c, the outer portion 224 of the flexible membrane 140c is driven downwardly, causing the lower vertex 226 the outer portion 224 to apply a load to the outer edge of the substrate. On the other hand, as shown in Figure 4B, if the pressure P_1 in the outermost chamber 168c is less than the pressure P_2 in the second chamber 166c, the outer portion 224 pivots so that the lower vertex 226 is drawn upwardly. This causes the outer edge of the main portion 142c to be drawn upwardly and away from the perimeter portion of the substrate, thereby reducing or eliminating the pressure applied on this perimeter portion. By varying the relative pressures in the chambers 166c and 168c, the radial width of the section of the membrane pulled away from the substrate can also be varied. Thus, both the outer diameter of the contact area between the membrane and the substrate, and the pressure applied in that contact area, can be controlled in this implementation of the carrier head.

A6

In the claims:

Please cancel claims 1, 2, 4 and 9.

Please amend claims 3, 5, 7, 13 and 15 as follows:

3. (Amended) A carrier head, comprising:

a housing to be secured to a drive shaft;

a base assembly;

a loading chamber controlling the position of the base assembly relative to the housing;

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